Guest Editorial

Marine Pollution: The Future Challenge Is to Link Human and Wildlife Studies


Bjørn Munro Jenssen

The rapid population growth and enormous urban and coastal development in many of the world's coastal regions have caused considerable concern that anthropogenic pollution may reduce biodiversity and productivity of marine ecosystems, resulting in reduction and depletion of human marine food resources. In addition, natural environments are important for recreation, and consequently for human health and welfare, and there is now increased awareness that nature has its own intrinsic value. Pollution reduces the aesthetic value and perhaps also the intrinsic value of the marine environment, whether the pollution is visual (such as oil pollution and plastic debris) or invisible (such as chemical compounds).

Another main reason for concern about marine pollution is related to the direct effects of pollution on human health. Because many pollutants accumulate in marine organisms, humans are exposed to pollutants when they consume food from polluted areas. Several studies have documented that human populations that consume large amounts of marine food have high burdens of persistent organic pollutants (POPs), such as dioxins, furans, polychlorinated biphenyls (PCBs), and some heavy metals. There has been a particular focus on indigenous people who consume large amounts of marine food, including blubber products of marine mammals (Dewailly et al. 1999).

Because construction of treatment facilities for sewage is unlikely to catch up with increasing human activities, especially in developing countries, eutrophication and hypoxia will be a persistent problem. Also, exposure of marine organisms to increasing concentrations of human bacteria may pose a threat to coastal ecosystems. High levels of natural and synthetic compounds with estrogenic properties in sewage effluents have been linked to feminization of fish. There is also concern about other chemicals with endocrine-disrupting properties. One example is the marine antifouling paint ingredient tributyltin, which has been shown to cause imposex in gastropods, to affect coastal and estuarine molluscs populations, and to cause reduction of species diversity in marine estuarine benthic and epibenthic invertebrate communities (Matthiessen and Law 2002). Until now, most studies concerned with the effects of marine pollution have focused on biochemical and physiologic effects. In the future, studies should address the effects of pollution on behavioral traits that can potentially alter biodiversity and ecosystem functioning. Examples of such ecologically significant behavioral traits are antipredator behavior, reproductive behavior, parental behavior, and feeding success (Wibe 2003).

Recent reports have documented dose relationships between mercury, dioxins, furans, and PCBs and several reproductive, cognitive, and neurologic factors in humans. Obviously, there is a clear need to pursue such studies, and there is a particular need to identify possible confounding factors. Breast-feeding and the quality of the home environment are examples of identified confounding factors that may modify and actually counteract harmful effects of POPs (Jacobson and Jacobson 2002; Walkowiak et al. 2001).

Many marine mammals are highly dependent on well-developed cognitive abilities and must have a normal behavior to survive. The selection against cognitive and neurologic dysfunction or retardation is most likely much more significant in wildlife than in humans. Thus, there is also a great need for wildlife studies that focus on the effects of marine pollution on cognitive abilities and related neurologic effects, and it is of great interest how such effects can affect biodiversity and ecosystem functioning.

The harmful effects of many POPs on human and environmental health have been recognized, and in 2000, an international ban was implemented on the 12 most noxious POPs, the so-called "dirty dozen" (Kaiser and Enserink 2000). During the last two decades, the concentrations of many pollutants in marine biota have declined. However, every year thousands of new synthetic chemicals are produced, and recently there have been reports of so called "novel" POPs in humans and in marine biota. The best known are brominated flame retardants (BFRs), such as polybrominated diphenyl ethers (De Wit 2002). The capacity of these chemicals to bioaccumulate, biomagnify, and provoke effects in marine organisms and humans is still unclear. This is also the case for other "novel" POPs such as perfluorooctane sulfonate and polychloronaphtalenes, which have been detected in marine food webs (Corsolini et al. 2002; Giesy and Kannan 2001). These pose a new threat to the health of individuals and both human and wildlife populations.

Arctic animals live far from most pollution sources, but some species such as the polar bear (*Ursus maritimus*) and the beluga whale (*Delphinapterus leucas*) have been reported to have very high levels of some POPs (Andersen et al. 2001; Norstrom et al. 1998). This is due to a combination of their trophic position in the Arctic marine food web and the fact that POPs are transported to the Arctic via the atmosphere. In beluga whales, exposure to polycyclic aromatic hydrocarbons has been linked to high rates of cancer (Martineau et al. 2002). In the polar bear there are indications that thyroid and sex hormones, retinols, and immune function are affected by POPs (Haave et al. 2003; Skaare et al. 2002). However, it is still unclear if populations of these species are at risk due to marine pollution.

In studies concerning health effects of marine pollution on humans and on wildlife, there is often a range of confounding intrinsic and extrinsic factors (De Guise et al. 2001) that can make it difficult to provide clear evidence that populations or subpopulations are affected by marine pollution. To obtain better knowledge of effects of marine pollution on populations, more focus should be put on integrating results from human and wildlife studies, which are often viewed separately. This will help to identify important confounding factors and to improve background knowledge for hazard assessment with respect to effects of marine pollution on the health of individuals and human and wildlife populations.

Bjørn Munro Jenssen
Department of Biology
Norwegian University of Science and Technology
Trondheim, Norway
E-mail: bjorn.munro.jenssen@bio.ntnu.no

Bjørn Munro Jenssen is a Professor of ecotoxicology. His research focuses on physiologic, behavioral, and ecological effects of polyhalogenated organic pollutants in a wide range of wildlife species, from amphibians to polar bears. He particularly focuses on effects related to endocrine disruption.

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Note from the Editor-in-Chief

This issue of *EHP* contains more than double the number of research articles found in a typical issue of *EHP*. Although all articles are now published within 24 hr of acceptance, there is a lag time from publication online to a print issue. This one-time expanded Research Section is our way of reducing the lag time and expediting publication. Other methods being instituted include starting articles on right- and left-hand journal pages, which allows us to publish more articles in each issue, and requiring more concise articles. We have also found it necessary to become more selective in our acceptance process. As always, I welcome your comments as we try to further enhance the value of *EHP* to the environmental health community.